Chapter 12 Noise and Vibration

12.1 Introduction

This chapter, prepared by AWN Consulting, presents an assessment of the impacts of the proposed Dursey Island Cable Car and Visitor Centre in terms of noise and vibration of the local environment as defined in the following Environmental Protection Agency guidance documents:

- Advice Notes on Current Practice in the Preparation of EIS (2003);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports Draft August 2017; and
- Guidelines on the Information to be Contained in Environmental Impact Statements, 2002

The study has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken in the vicinity of the proposed development in order to characterise the existing noise environment;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations have been performed for the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the nearest sensitive locations. A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.

The following British Standards were also consulted when carrying out this assessment:

- BS 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound*;
- BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2; and
- BS 8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings*.

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12.2 Receiving Environment

A baseline environmental noise survey was conducted in the vicinity of the proposed development in order to quantify the existing noise environment at the nearest noise-sensitive locations that may be affected by the proposed development.

A baseline survey of vibration along the proposed development was not undertaken as existing levels in the vicinity of the proposed development are not expected to be of

a magnitude sufficient to cause disturbance to people or structural damage to property. Furthermore, vibration was not perceptible at any of the noise survey locations.

12.2.1 Survey Periods

An attended noise survey was conducted at 3 locations on 25 February 2019 between 11:30 and 14:45 hours. Note that the purpose of the baseline noise survey is to establish the baseline noise environment during the quietest period of the season in order that any subsequent construction and operational noise criteria set are suitable for all times of the year, including off season.

12.2.2 Measurement Locations

The measurement location descriptions are presented in Table 12.1 below and illustrated in Plate 12.1.

Table 12.1 Baseline Noise Monitoring Locations

Survey Location	Description
AN1	In the vicinity of the nearest residential property to the existing cable car
AN2	At the existing cable car carpark
AN3	On Dursey Island at a location considered representative of the nearest residential properties to the cable car on the island

Plate 12.1 Baseline Noise Monitoring Locations

12.2.3 Instrumentation

The measurements were performed using a Brüel & Kjær Type 2250 Sound Level Meter. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

12.2.4 Procedure

Measurements were conducted on a cyclical basis at the locations noted above. Sample periods for the noise measurements were 15 minutes at each location with each location sampled three times. The results were noted onto an Environmental Noise Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for later analysis where required. Survey personnel noted the primary noise sources contributing to noise build-up.

12.2.5 Weather

The weather was dry and mild (10°C) but breezy with windspeeds of 10 to 15 m/s. Wind speeds were noted to be much lower only a few kms inland.

12.2.6 Measurement Parameters

The noise survey results are presented in terms of the following five parameters:

$L_{Aeq, T}$ is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the period T. It is typically used as a descriptor for ambient noise.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

12.2.7 Results of Noise Surveys

Table 12.2 presents the results of the attended measured noise levels for each of the three survey locations. The results of the survey have indicated that baseline noise levels at all locations assessed are dominated by sea and wind noise. The existing cable car is silent in its operation.

At location AN1 the noise climate was dominated by sea and wind noise with some bird calls audible. There were 1 or 2 car movements past the survey location during the course of the measurements. Ambient noise levels were measured in the range of 50 to 51 dB L_{Aeq}. Background noise levels were in the range of 48 to 49dB L_{A90}.

At location AN2 the noise climate was also dominated by sea and wind noise with some bird calls audible. Ambient noise levels ranged from 52 to 62 dB L_{Aeq}, the highest value measured during a particularly gusty period. Background noise levels were in the range of 50 to 56 dB L_{A90}.

At location AN3 the noise climate was dominated by sea and wind noise with some bird calls audible. No man-made noise sources were audible at this location. Ambient noise levels ranged from 52 to 53 dB L_{Aeq}. Background noise levels were in the range of 49 to 50 dB L_{A90}.

Table 12.2 Baseline Noise Monitoring Results

Survey Location	Start time	Measured Noise Levels (dB re.2x10^{-5}Pa)					Notes
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
AN1	11:30	51	64	47	52	49	Sea and waves main contributing noise source. Wind noise also contributed. Seagulls and 2 cars passed survey location. Cable car not audible at this location.
	11:45	50	65	47	52	49	Sea and waves main contributing noise source. Wind noise also contributed. Seagulls. Cable car not audible at this location.
	13:45	50	66	46	51	48	Sea and waves main contributing noise source. Wind noise also contributed. 1 car passed survey location. Cable car not audible at this location.
AN2	12:15	62	77	52	66	56	Measurement taken at cable car launch area. Cable car did not contribute to measured noise level/ambient noise. Wind and sea main contributors. Elevated and exposed location.
	14:10	53	73	48	53	50	Measurement taken at lower location in public car park underneath cable car. Cable car not audible. Sea and wind main contributing noise source.
	14:30	52	59	48	53	50	Measurement taken at lower location in public car park underneath cable car. Cable car not audible. Sea and wind main contributing noise source.
AN3	12:40	52	67	48	53	49	No man-made noise sources audible including cable car. Sea and wind noise.
	12:55	53	71	47	54	50	As above
	13:10	53	70	48	55	50	As above

12.3 Methodology

12.3.1 Construction Assessment Criteria

Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In lieu of statutory guidance, an assessment of significance has been undertaken as per British Standard *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 12.3 sets out the values which, when exceeded, signify a significant effect at the façades of residential receptors.

Table 12.3 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A[A]	Category B[B]	Category C[C]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and weekends [D]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

[D] 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined through a logarithmic averaging of the measurements for each location and then rounded to the nearest 5dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. Table 12.4 presents the assigned *BS 5228-1:2009+A1:2014* categories and threshold values for each baseline location.

Table 12.4 Defined Construction Noise Thresholds

Survey Location	$L_{Aeq,T}$	Ambient Noise Level Rounded to Nearest 5 dB L_{Aeq}	BS 5228-1:2009+A1:2014 Category	Construction Noise Threshold Value (dB) ($L_{Aeq,T}$)
AN1	50	50	A	65
AN2	55-60	60	A	65

Survey Location	$L_{Aeq, T}$	Ambient Noise Level Rounded to Nearest 5 dB L_{Aeq}	BS 5228-1:2009+A1:2014 Category	Construction Noise Threshold Value (dB) ($L_{Aeq, T}$)
AN3	55	55	A	65

Vibration

In terms of vibration, *BS 5228-2:2009+A1:2014* recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (PPV) (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis, to use this lower value. Taking the above into consideration the vibration criteria in Table 12.5 are recommended.

Table 12.5 Defined Construction Vibration Thresholds for Structurally Sound Buildings

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:-		
Less than 15Hz	**15 to 40Hz**	**40Hz and above**
15 mm/s	20 mm/s	50 mm/s

Note that the above thresholds are specified for transient or intermittent vibrations. Some construction activities may give rise to continuous vibrations. In these instances, the guidance recommends that the previously defined thresholds are reduced by at least 50%.

12.3.2 Operational Assessment Criteria

Vehicular Noise

The main potential source of outward noise associated with the development is noise due to vehicular traffic accessing the development. In order to assist with the interpretation of the noise associated with vehicular traffic on existing public roads, Table 12.6 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source Design Manual for Roads and Bridges (DMRB), 2011).

Table 12.6 Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level (dB L_{A10})	Subjective Reaction	Magnitude of Impact
0	Inaudible	No Impact
0.1 – 2.9	Barely Perceptible	Negligible
3 – 4.9	Perceptible	Minor
5 – 9.9	Up to a doubling of loudness	Moderate
10+	Doubling of loudness and above	Major

Table 12.6 presents the DMRB (2011) likely impacts associated with change in traffic noise level. The corresponding significance of impact presented in the *EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports*

(EIAR), Draft, August 2017 is presented in Table 12.7 for consistency in wording and terminology for the assessment of impact significance.

Table 12.7 Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight, Moderate
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Significant
10.0 or more	More than a doubling or halving of loudness	Major	Very Significant, Profound

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

Plant Noise

In relation to external services plant noise that may be required to service the development, reference is made to BS 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound*. This document describes methods for rating and assessing sound of an industrial and/or commercial nature to a residential receptor. The methods described in this standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The results of baseline surveys of the prevailing background sound level allow for the noise impact associated with proposed new external plant items to be assessed. With reference to BS 4142:2014, it is noted that, depending on context, adverse impacts are likely to occur when rated plant sound level exceeds the prevailing background sound level by +5dB, with a significant adverse impact occurring at +10dB or more. Where the rating level does not exceed the background sound level, BS 4142 comments that this is an indication of the specific sound source having a low impact, again depending on the context.

12.4 Potential Impacts

During the construction phase the main site activities will include site clearance, earthworks, substructure and super structure construction. This phase will involve the use of various mobile plant, excavators, cranes and other standard construction machinery throughout most of the site. Although it is expected that the earthworks and substructure works are likely to give rise to noise and vibration emissions, the impact is considered relatively short-term in nature and is assessed in Section 12.4.1.

12.4.1 Construction Phase

Noise

Construction noise has been predicted at the nearest noise sensitive location. The receptor location is presented in Plate 12.2.

Plate 12.2 Noise Sensitive Receptor Location

A variety of items of plant will be in use for the purposes of site clearance and construction. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

The main elements of construction for the proposed development can be summarised as follows:

- Site preparation including establishment of boundary security, site clearance, and diversion, removal or protection of existing services as necessary;
- Approach road improvement works;
- Earthworks (cutting and filling);
- Construction of cableway infrastructure – 2 no. stations, 2 no. pylons and installation of cableway machinery, ropes and cable cars;
- Buildings and associated services and civils works:
  - Visitor Centre / gift shop;
  - Café with toilet block;
  - Mainland station building (drive station) with staff facilities, workshop and storage;
  - Energy Centre;
  - Island station building (return station) with welfare facilities;
- Pavement, drainage and wastewater treatment installations;
- Landscaping and finishes

Due to the fact that the construction programme is not progressed to a detail level at this stage of the programme, it is not possible to calculate specific noise emissions to the local environment from different phases of works. However, the following tables present calculations of indicative noise levels for typical noise sources associated with construction.

BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise sets out typical noise levels for items of construction plant. Table 12.8 sets out assumed plant items during the key phases of construction with the associated source reference from BS5228 *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise*. The closest property to the proposed visitor centre is over 200m away, however, in addition to the main visitor centre works there are also 10 no. passing bays and 1 no. visibility splay being constructed along the R572 which will result in road works being carried out at various distances from 10m to 50m from dwellings.

Table 12.8 Indicative construction noise calculations at closest properties to works

Construction Activities	Calculated Construction Noise Levels, dB $L_{Aeq,1hr}$		
	10m	**50m**	**200m**
Site Clearance & Preparation			
Wheeled loader C2-26	n/a		45
Tracked excavator (loading dump truck) C1-10			51
Dozer C.2.10			46
Dump Truck C2.30			45
Rock Breaking C9.12			56
General Construction (Building & Cableway)			
Wheeled loader C2-26	n/a		47
Tracked excavator (loading dump truck) C1-10			53
Crane C4.38			46
Dump Truck C2.30			47
Circular Saw C4.71			58
Diesel Generator C4.84			47
Angle Grinder C4.93			53
Road Works			
Tracked excavator (C2.21)	71	50	n/a
Dump Truck (C2.30)	79	58	
vibration rollers (C5.20)	75	54	
Asphalt Paver & Tipping Lorry (C.5.31)	77	56	
Diesel Generator (C4.76)	61	40	
Road Rollers (C5.19)	80	59	

The results of the assessment have indicated that at distances of 10m from the works, the construction daytime noise limit of 65dB L_{Aeq} is likely to be exceeded. This scenario applies only to locations which are in immediate proximity to road works along the R572 which are expected to last for a short duration. At distances of 50m and beyond noise levels associated with construction plant items are further reduced and are typically within the daytime noise construction criterion.

Whist the calculations have demonstrated that works can be conducted within the adopted criteria at certain distances, it is recommended that the various best practice working methods used to control noise and vibration are adopted by the contractor during all works.

Vibration

The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works, road rolling and lorry movements on uneven road surfaces. The more significant of these is the vibration from road rolling; the method of which will be selected and controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings.

12.4.2 Operational Phase

Noise

There are two primary sources of operational noise that may be associated with the development:

- Plant servicing the Visitor Centre, and;
- Additional vehicular traffic.

Plant Servicing the Visitor Centre

Once a development of this nature becomes fully operational, a variety of electrical and mechanical plant will be required to service the Visitor Centre. Most of this plant will be capable of generating noise to some degree. Some of this plant may operate 24 hours a day, and hence would be most noticeable during quiet periods (i.e. overnight). Noisy plant with a direct line-of-sight to noise sensitive properties would potentially have the greatest impact.

In this instance, based on the baseline noise environment, mechanical plant serving the Visitor Centre, will be controlled in accordance with BS 4142 such that the existing noise environment is not increased. Note that this applies to the plant required for normal operations, emergency or back-up plant such as the generator and related equipment will not be subject to the same noise limits.

Given the distance from the Visitor Centre buildings to the nearest sensitive locations is in excess of 200m, it is expected that once new plant is controlled such that noise emissions do not exceed 85dB at 1m, the requirements of BS4142 will be met and the existing noise climate is not expected to change.

Additional Vehicular Traffic

A traffic impact assessment relating to the proposed development has been prepared by Roughan & O'Donovan as part of this application. Information from this report has been used to determine the predicted change in noise levels along the R572, for the opening (2023) and design (2038) years of the development.

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on the existing road network. Traffic flow data for the peak hour period during the peak season have been assessed and the calculated change in noise levels during this period is summarised in Table 12.9. The predicted increase in noise level has been calculated in accordance with the approach outlined in the Calculation of Road Traffic Noise (CRTN) which is the preferred calculation methodology for assessing road traffic noise in Ireland.

Table 12.9 Change in Traffic Noise Levels During Peak Months (July & August) with Proposed Development

Road	Base Year Daily Vehicle Movements	Opening Year with Development Daily Vehicle Movements	Change in Noise Level dB (A)	Base Year Daily Vehicle Movements	Design Year With Development Daily Vehicle Movements	Change in Noise Level dB (A)
R572	470	476	+0.1	470	501	+0.3

Making reference to the predicted change in traffic noise level in Table 12.9 and comparing it to the table of significance effects from Table 12.7, it can be seen that the proposed development is expected to have a negligible impact on the noise environment.

In summary, the future traffic volumes associated with the development are not expected to increase the existing noise levels by any noticeable amount. Note that it is proposed to limit the visitor numbers to the mainland Visitor Centre to 100,000 per annum which will ensure that traffic volumes do not increase significantly.

Vibration

No vibration emissions are expected from the operation of the proposed Visitor Centre.

12.4.3 Human Health Impacts

Construction Impacts

The assessment found that there is potential for some short term and temporary noise and vibration impacts during construction. However, with the application of standard construction methods, binding hours of operation and mitigation measures detailed in this chapter, any impacts due to noise and vibration will be temporary in nature and will not impact on human health.

Operational Impacts

There are no likely significant impacts due to noise or vibration during the operational phase that will impact on human health.

12.5 Mitigation Measures

12.5.1 Construction Phase

Noise

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within *BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2*. It is expected that the contractor will ensure that all best practice noise and vibration

control methods will be used as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the contractor will manage the works to comply with noise limits outlined in *BS 5228-1:2009+A1 2014. Part 1 – Noise*;
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Establishing channels of communication between the contractor/developer, Cork County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration;
- The Contractor shall appoint a Site Environmental Manager (SEM) who is responsible for matters relating to noise and vibration.;

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise and/or vibration;
- Erection of good quality, printed site hoarding which will act as a noise barrier to general construction activity at ground level;
- Erection of barriers as necessary around items such as generators or high duty compressors; and
- Situate any noisy plant as far away from sensitive properties as permitted by site constraints.

Working Hours

Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:30hrs Saturday and Sunday. Works will not be undertaken outside these working hours without the written permission of Cork County Council.

12.5.2 Operational Phase

During the operational phase of the development, noise from building services equipment serving the Visitor Centre will be selected such that the noise emission does not exceed 85dB(A) at 1m from the plant item.

No mitigation measures are necessary with respect to the control of noise or vibration impacts from additional vehicular traffic.

12.6 Residual Impacts

12.6.1 Construction Phase

During the construction phase of the project there is the potential for impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts will be reduced as far as is reasonably practicable. The resultant residual noise impact from this source will be of negative, significant, short-term impact.

Table 12.10 Description of Construction Phase Effects

Quality	Significance	Duration
Negative	Significant	Short-term

12.6.2 Operational Phase

During the operational phase it is expected that noise emissions from the development will not be perceptible above the existing noise environment resulting in a neutral, imperceptible, long-term impact.

Table 12.11 Description of Construction Phase Effects

Quality	Significance	Duration
Neutral	Imperceptible	Long-term

12.7 Difficulties Encountered

No difficulties were encountered during the preparation of this chapter.

12.8 Conclusion

The proposed Dursey Island Visitor Centre has been assessed to determine the potential of the development to generate a noise or vibration impact.

During the construction phase of the project there is the potential for impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts will be reduced as far as is reasonably practicable.

At operational stage it has been found that the change in road traffic volumes on the main access route to the site, via R572, will not change significantly as a result of the development. The predicted change in the noise environment during the peak season

is less than 1dB which is considered to be negligible. Building services plant will be selected at design stage such that any noise emissions from this plant do not result in a noticeable increase in the existing noise environment at the nearest residential dwellings.